

Systematic remarks on a rare Crotalid
snake from Ecuador,
Bothriechis albocarinata (Shreve),
with some comments
on the generic arrangement
of arboreal Neotropical pitvipers

by

Beat SCHÄTTI *, EUGEN KRAMER ** & Jean-Marc TOUZET ***

With 3 figures

ABSTRACT

The examination of the type material of *Bothrops albocarinata* Shreve and *B. alticola* Parker revealed some deviations vis-à-vis the original descriptions (e.g. number of interoculars; number of ventrals and contact of subocular with labials). These nominal forms are considered to be conspecific (*Bothriechis albocarinata*). Four specimens of this apparently rare pitviper exhibit variation in some morphological characters (i.e. condition of subcaudals, midbody dorsal scale rows, circumocular scales, internasals etc.). The systematic arrangement of Neotropical pitvipers does not appear to be based on sound evidence for the time being. At least some groupings seem to be artificial.

* Muséum d'Histoire naturelle, case postale 434, CH-1211 Genève 6, Switzerland.

** Naturhistorisches Museum, Augustinergasse 2, CH-4051 Basel, Switzerland.

*** Fundación Herpetológica Gustavo Orcés, Castilla 448 A, Quito, Ecuador.

INTRODUCTION

During the past years the Natural History Museum of Geneva (MHNG) received a considerable number of amphibians and reptiles from different parts of Ecuador. Among this material there are several species of arboreal pitvipers. Three specimens from the provinces of Morona Santiago and Zamora Chinchipe show a mixture of features which are considered to be characteristic for *Bothriechis albocarinata* (Shreve) and *B. alticola* (Parker). Because our material does not unequivocally fit the description of neither of these forms, we take an examination of the type material to be opportune. At the same time, some critical comments on the currently accepted arrangement of Neotropical pitvipers (BURGER 1971, CAMPBELL & LAMAR 1989) seem to be necessary.

The type material is deposited in the British Museum (Nat. Hist.) at London (BM) and the Museum of Comparative Zoology in Cambridge, Massachusetts (MCZ). A specimen without precise locality data housed in the collection of the Escuela Politécnica Nacional (EPN) at Quito is also included in this study. We are grateful to A. Almendariz (Quito), Colin McCarthy (London) and José P. Rosado (Cambridge) for the loan of these specimens. Corinne Charvet typed the manuscript. The authors are also indebted to James R. Dixon (College Station, Texas) for a critical review of the manuscript and to Rosario Agosti-Gonzalez (Zürich) for the Spanish summary.

MORPHOLOGY AND DISTRIBUTION

The type of *Bothrops albocarinata* (♀, MCZ 36989; Río Pastaza) has 181 ventrals (DOWLING-method, 1951), 59 mostly single subcaudals (except 1, 4 and 56-58), 21 dorsal scale rows around midbody, 9/8 supralabials (right/left, 3rd forming lacunolabial) and 10 sublabials. The internasals are separated from each other by a small scale behind the rostral; there are 6 to 9 interoculars (counted along a straight line between half the length of the supraoculars) and nine scales around the eye (3 preoculars, 2 suboculars and 4 postoculars); the suboculars are separated from the supralabials by a complete row of small scales. In the type of *Bothrops alticola* (♂, BM 1946.1.19.26: "Loja", Ecuador) there are 173 ventrals, 64 + n subcaudals (incomplete; 1-20 single, the remainder divided), 19 midbody scale rows, 7 supralabials (2nd forming lacunolabial) and 9 sublabials. This specimen has the internasals in contact, 5 interoculars, 3 preoculars, a very long and narrow subocular and two granular postoculars. There is an extremely small additional scale between the subocular and the border of the third and fourth supralabial, but otherwise these scales are in contact.

In a juvenile (♂, MHNG 2226.34) from Morona Santiago province, there are 161 ventrals (28 and 39 only developed at the left hand side), 60 subcaudals (single, with exception of 1, 58 and the last one), 21 midbody scale rows, 7 supralabials and 10 sublabials; internasals in contact, 7 interoculars (circumocular area damaged). MHNG 2444.18, a ♀ from Macas (Morona Santiago, 1500 m) has 171 ventrals, 57 subcaudals (mostly divided, except 2-3, 7, 14-16 and 35-36), 19 midbody scale rows, 7 upper and 8 lower labials; internasals separated by an additional scale behind the rostral, 7 interoculars, 3 preoculars, a long and narrow subocular and one postocular; there is a complete row of scales separating the subocular from the labials. MHNG 2464.31, a ♀ from Nambija (Zamora Chinchipe, ca. 1800 m) has 175 ventrals, 54 divided subcaudals, 21 midbody scale rows, 7 supralabials and 10 lower labials; on the right hand side, the

anterior part of the *canthus rostralis* is made up of two scales which are separated from the left internasal by a small scale behind the apical shield; there are 7 to 8 interoculars, 3 preoculars, a very long and narrow subocular, and 2/1 postoculars; a complete row of small scales separates the subocular from the upper labials. A ♂ from Cotundo (Napo, EPN RM 309) has 176 ventrals, 66 subcaudals (1-3 and 30-66 divided), 21 midbody scale rows, 7 upper and 8 lower labials; the internasals are in contact and there are 6-7 interoculars, 3 preoculars, a narrow subocular and 4/3 postoculars. The subocular is at least partly in contact with the supralabials; on the left hand side, the subocular reaches to the postocular region and there are four scales (two on the right) of variable size laying between the subocular and the labials.

TAB. 1.

Morphological characters in *Bothriechis albocarinata*. For further explanations see text.

	MCZ 36989	BM 1946. 1.19.26	MHNG 2226.34	MHNG 2444.18	MHNG 2464.31	EPN RM 0309
origin	Río Pastaza	“Loja”	M. Santiago	Macas	Nambija	Cotundo
sex	♀	♂	♂	♀	♀	♂
ventrals	181	173	161	171	175	176
subcaudals	59	64 + n	60	57	54	66
condition of subcaudals	mostly single	variable	mostly single	mostly divided	divided	variable
dorsals	21	19	21	19	21	21
internasals	separated	in contact	in contact	separated	separated	in contact
supralabials	9/8	7	7	7	7	7
contact of subocular/labials	separated	partly in contact	?	separated	separated	partly in contact
interoculars	6-9	5	7	7	7-8	6-7

Apart from the number of ventral and subcaudal scales, the types of *Bothriechis albocarinata* and *B. alticola* differ in midbody dorsal scale rows, the number of upper and lower labials (including lacunolabial), in the snout region (internasals separated by a small scale behind the rostral in *albocarinata*, touching each other in *alticola*), the number of interoculars and circumocular scales, the condition of the subcaudals (predominantly single or divided, respectively), the contact of the subocular with respect to the supralabials (tab. 1) as well as in colouration (greyish green versus greenish yellow) and pattern. In *albocarinata*, the first row of dorsals is coloured alternating black and greenish

white, and the lower surface is marked with black squarish spots. The type of *alticola* has a series of transverse black spots partly forming regular bars along the back, and the venter is uniformly yellow on the anterior part but with black mottlings increasing in amount posteriorly.

The condition of the subcaudals, number of midbody dorsal scale rows, the arrangement of the circumocular scales and internasals as well as the suborbital area are also found to be variable in the remaining material at hand. In our specimens, there are always seven supralabials (2nd forming lacunolabial). It seems that the type of *albocarinata* represents aberrant states in these features.

The colouration of the juvenile viper (MHNG 2226.34) corresponds to the pattern found in the type of *albocarinata*, i.e. greyish above (in alcohol) with a distinct postocular stripe, the ventral surface mostly light (creamish) and the tip of the tail uniform, probably yellow or orange in life. These specimens also agree with regard to the condition of the subcaudals and number of dorsal scale rows but differ as to the number of supralabials and the condition of the internasals. Colouration and pattern of MHNG 2444.18 are virtually identical with the type of *alticola*. These two specimens agree with each other in the number of dorsal scale rows and supralabials (tab. 1). MHNG 2464.31 and RM 309 are identical in pattern and colouration (figs 1 and 2).

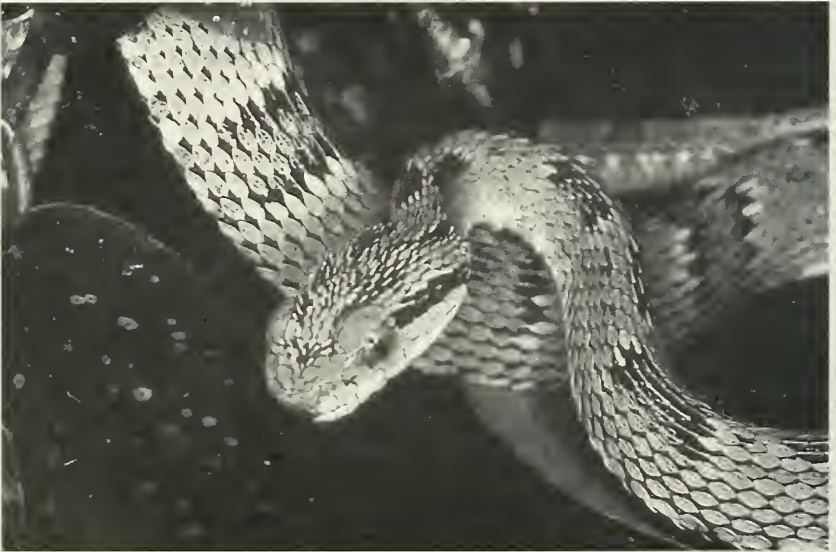


FIG. 1.

A female of *Bothriechis albocarinata* from Zamora Chinchipe (MHNG 2464.31).

The number of midbody dorsal scale rows, supralabials, interocular and circumocular scales are variable in many species of Neotropical pitvipers (see tabs 28 and 29 in CAMPBELL & LAMAR 1989). PETERS (1960) and PETERS & OREJAS-MIRANDA (1970) thought that *albocarinata* and *alticola* represent valid species whereas BURGER (1971) con-

sidered them to be identical. Likewise, CAMPBELL & LAMAR (1989) demonstrated problems with the distinction of these forms and they "suspect strongly that only a single species is represented". This judgement is confirmed by the material in question. The original descriptions of these nominal forms were published at almost the same time, i.e. in May (SHREVE 1934) and August (PARKER 1934), respectively. Therefore, *albo Karinata* has priority over *alticola*.

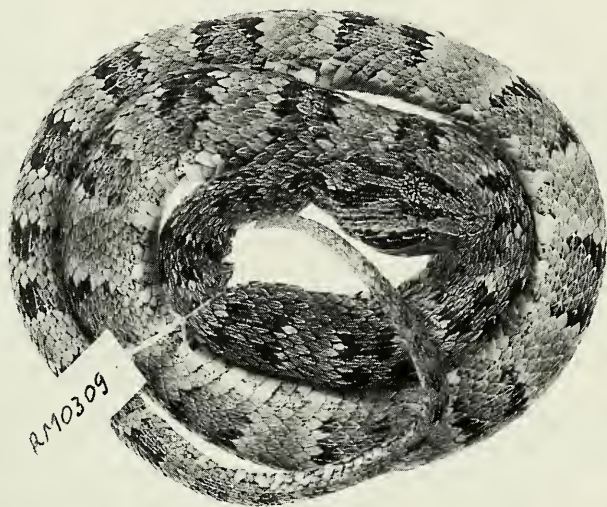


FIG. 2.

Another specimen of *B. albo Karinata* (EPN RM309, ♂) from Ecuador.

Certainly, the type locality of *Bothriechis alticola* ("5 km east of Loja, 9200 ft") is incorrect (fig. 3). Although Parker had been at Loja himself, this specimen was obtained from Carrion who in turn had received this and other snakes from a local dealer. We have hardly any doubt that the type of *alticola* has most probably been collected on the eastern slopes of the Andes somewhere near the highway from Loja to Zamora (Province of Zamora Chinchipe).

The specimen from Nambija¹ comes from an area which is situated 30 km NE of Zamora. This snake has 21 midbody scale rows at midbody, the internasals are separated and there is no contact between the subocular and the supralabials. On the other hand, it differs from the type of *albo Karinata* in the condition of the subcaudals and the number of supralabials.

Bothriechis albo Karinata is an arboreal species known from the Amazonian drainage of Ecuador and Perú. It lives in cloud forest and upper rainforest habitats and has been

¹ This snake lived several months in captivity and fed on frogs (*Eleutherodactylus* sp., *Gastrotheca* and *Oloolygon*) and lizards (*Anolis fuscoauratus*) but refused to accept mice and birds. It died evidently by envenomation after having taken *Hyla variegata* and *H. triangulum*.



FIG. 3.

Known distribution of *B. albocarinata*. Inexact records are marked with an asterisk; the question mark refers to "Loja". The broken line corresponds to the border as declared by the Conference of Rio de Janeiro in 1942.

taken at altitudes up to approx. 2000 m (500 to over 3000 according to CAMPBELL & LAMAR 1989, who may take into account the alleged type locality of *B. alticola*). So far, this species is known on the basis of a limited number of specimens from Ecuador (provinces of Napo, Pastaza, Morona Santiago and Zamora Chinchipe) and the Iquitos area in Perú (MENESES 1974). The type locality ("Río Pastaza, between Canelos and Río Marañon") might well be situated on Peruvian territory (fig. 3).

B. albocarinata has a rounded snout and a moderately elevated *canthus rostralis*; the internasals, canthals and supraoculars are enlarged and rugose, the dorsal head scales and temporals are keeled. The nasals are divided and there are 7-9 supralabials (2nd or 3rd forming lacunolabial), 8-10 lower labial scales and 5-9 interoculars. There are 19-21 dorsal scale rows at midbody; with the exception of the lowermost row all scales are strongly keeled. This species has 161-181 ventrals (♂♂ 161-176, ♀♀ 171-181), an undivided anal plate, and a prehensile tail with 53-66 subcaudals (60-66 and 54-59, resp.). The maximum total length is 750 + 100 mm (MHNG 2444.18). The longest male is the type of *alticola* with a body length of 552 mm (tail uncomplete). The head pattern of all specimens exhibits a diagonal black stripe from behind the eye to the angle of the mouth, and a parallel stripe on the occiput from above each supraocular. Differences in body pattern results from the

fact that in some specimens (type of *alticola* and MHNG 2444.18) the blotches are entirely black (with some yellow on the keels and towards the tip of some scales) whereas this markings have a light center similar to the body ground colour. The number of dorsal bands on the body ranges from 20 to 30. There seems to be no sexual dimorphism in pattern and colouration.

RELATED SPECIES

Four additional species of pitvipers with prehensile tails are known from Ecuador, i.e. *Bothriechis schlegelii* (Berthold), *B. bilineata smaragdina* (Hoge), *B. punctata* (García) and *B. taeniata* (Wagler). Only *smaragdina* and *taeniata*, both inhabiting the Amazonian Basin from Colombia to Bolivia and Brasil occur within the range occupied by *albocarinata*. These forms are easily separable on the basis of colour pattern and scale counts: *smaragdina* is uniformly green above with small black dots on the scales ("pepper pattern"), lacks a distinct postocular stripe, has more than 190 ventrals and 23-25 mid-body scale rows; still higher scale counts (25-29 dorsal rows, 203-254 ventrals) are found in *taeniata*. *B. schlegelii* ranges from S Mexico to E Venezuela and W Ecuador (Manabí, Cotopaxi); this is a highly variable form which differs from *albocarinata* by the presence of supraciliary scales which are normally considerably raised to form "eyelashes", and more (23-25) midbody scale rows.

PARKER (1934) supposed a relationship of *alticola* with a number of Central and South American forms (*medusa*, *nigroviridis*, *oligolepis* and *peruviana*). *B. medusa* is endemic to the coastal mountains in Venezuela, lacks a prehensile tail and has a characteristic dorsal pattern; *nigroviridis* ranges from Costa Rica to Panama and differs from *albocarinata* in more supralabials (8-11) and less ventrals (up to 158); *peruviana* lives in a comparatively small area in the borderland between Perú and Bolivia (Puno province) and is likewise distinguishable from *albocarinata* in the number of ventral counts (188-196, fide CAMPBELL & LAMAR 1989) and more dorsal scale rows at midbody (23 instead of 19-21). *B. oligolepis* is known from the central parts of S Perú and adjoining areas in Bolivia. This form has 23-25 dorsal scale rows; general appearance and colouration are similar to the type of *alticola* and MHNG 2444.18. On the other hand, MHNG 2464.31 (fig. 1) has a colour pattern which resembles the one found in *peruviana* (CAMPBELL and LAMAR 1989, fig. 155). In fact, SHREVE (1934) considered *Bothrops chloromelas* (= *Bothriechis oligolepis*) to be closely allied with *albocarinata*, an opinion which is also shared by us. There is a striking similarity in the head pattern of these two forms (see figs 153-154 and 167-168 in CAMPBELL & LAMAR 1989).

REMARKS TO THE GENERIC CONCEPT

BURGER (1971) presented a new systematic arrangement for Oriental and New World pitvipers. Following this author, the Neotropical terrestrial forms belong to *Bothrops* Wagler; species with a prehensile tail are attached either to *Bothriechis* ("palm-pitvipers", with *schlegelii* and six additional forms from Central America) or with *Bothriopsis* ("forest-pitvipers", including *albocarinata*, *bilineata*, *medusa*, *oligolepis*, *peruviana*,

punctata and *taeniata*). This point of view has also been adopted by CAMPBELL & LAMAR (1989)².

We do not oppose the idea that *Bothrops* (sensu BURGER 1971) probably represents a monophyletic group which differs from other Neotropical crotalids (except *Crotalus*, *Lachesis*) in deeply divided hemipenes. The statement that "the hemipenis is less valuable than many external features" to distinguish phylogenetic groups among New World pitvipers (BURGER 1971: 265) is questionable, and likely to be due to a limited number of preparations in a few species. Following CAMPBELL & LAMAR (1989), the lobes are sub-cylindrical or tapered with papillate calyces in *Bothriechis* and attenuated with a calyculate distal half in *Bothriopsis*; in the former taxon there are 10-24 large spines on the proximal portion of the hemipenis, whereas the number ranges from 30-40 (including some enlarged basal hooks) in the latter.

Although there might be some differences in the shape of the ectopterygoid and palatine in the type species of *Bothriechis* (*B. nigroviridis* Peters) and *Bothriopsis* (*B. quadriscutata* Peters, = *B. taeniata*), there seem to be transitional states in other arboreal species. Certainly the condition of the subcaudals (mostly entire in *Bothriechis*, divided in *Bothriopsis*) is a poor character, and the modified tail ("first and second row of dorsal scales on terminal one third of tail heavily keeled" in *Bothriechis*) is in our opinion not a useful character to subdivide the arboreal Neotropical pitvipers as proposed by BURGER (1971). As a matter of fact, the alleged differences between *Bothriechis* and *Bothriopsis* are at best gradual and we do not consider them to warrant a separation of these nominal genera prior to a detailed evaluation of features which are considered to be of phylogenetic significance.

RESUMEN

El examen de los tipos de *Bothrops albocarinata* Shreve y *B. alticola* Parker revelan algunas diferencias con respecto a las descripciones originales (por ejemplo número de los interoculares, número de los ventrales y contacto de subocular con labiales). Estas formas nominales son consideradas conspecificas (*Bothriechis albocarinatus*). Cuatro especímenes de este crotárido aparentemente poco común muestran una variación en algunos caracteres morfológicos (subcaudales dobles o simple, número de hileras de escamas dorsales en la parte central del cuerpo, escamas circumoculares, internasales, etc.). El orden sistemático de los crotálicos neotropicales no parece ser basado en una evidencia bien fundada por el momento. Al menos algunos grupos parecen ser artificiales.

² Like in the case of *Bothriechis* (meaning pitviper), and contrary to the opinion of PETERS & OREJAS-MIRANDA (1970), CAMPBELL & LAMAR (1989) and others, *Bothrops* (βοθρος: pit; οφίς (η): appearance, face) is of feminine gender as used for instance by PARKER (1934), SHREVE (1934) and BURGER (1971).

LITERATURE

- BURGER, W. L. 1971. Genera of pitvipers. *Ph. D., University of Kansas*, 186 pp., 9 figs, 7 tabs.
- CAMPBELL, J. A. & W. W. LAMAR. 1989. The venomous reptiles of Latin America. *Cornell Univ. Press, Ithaca*, 425 pp., 568 figs, 109 maps, 34 tabs.
- DOWLING, H. G. 1951. A proposed method of expressing scale reductions in snakes. *Copeia* 1951 (2): 131-134.
- MENESES, O. 1974. Ofidios y ofidismo en el Perú. II. Aspectos ecologicos de la fauna ofidica ponzoñosa. *Rev. Inst. Zoonos. Invest. Pecuaria* 2 (3-4): 79-84, tab.
- PARKER, H. W. 1934. Reptiles and amphibians from southern Ecuador. *Ann. Mag. nat. Hist.* (10) 80 XXV: 264-273.
- PETERS, W. 1859. Über die von Hr. Dr. Hoffmann in Costa Rica gesammelten und an das königl. zoologische Museum gesandten Schlangen. *Monatsb. Akad. Wiss. Berlin* 1859: 275-278.
- 1861. Beschreibung von zwei neuen Schlangen, *Mizodon* (sic) *variegatus* aus Westafrika und *Bothriopsis quadriscutata*. *Ibid.* 1861: 358-360.
- SHREVE, B. 1934. Notes on Ecuadorian snakes. *Occ. Pap. Boston Soc. nat. Hist.* 8: 125-132.